SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN – PHASE 2
CHEVRON SERVICE STATION NO. 9-6590
232 East Woodin Avenue
Chelan, Washington

October 21, 2016

Prepared for:
Washington State Department of Ecology
1250 West Alder Street
Union Gap, Washington 98903

Prepared by:
Leidos, Inc.
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Bothell, Washington 98011

On Behalf of:
Chevron Environmental Management Company
6001 Bollinger Canyon Road
San Ramon, California 94583

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1. INTRODUCTION AND OBJECTIVES

Leidos, Inc. (Leidos), on behalf of Chevron Environmental Management Company (Chevron), prepared this work plan to perform additional Supplemental Remedial Investigation (SRI) activities at Chevron Service Station No. 9-6590 (the Site), located at 232 East Woodin Avenue in Chelan, Washington (Figure 1). SRI activities for the Site are being performed pursuant to the terms of Agreed Order No. DE 10629, which was entered into by Chevron and the Washington State Department of Ecology (Ecology) in June 2014.

The objective of the SRI Phase 2 activities is to address data gaps regarding the vertical extent of petroleum hydrocarbon contamination and light non-aqueous phase liquid (LNAPL) at the Site, and to facilitate a greater understanding of the extent of shallow perched groundwater at the Site and its relationship to Lake Chelan. Specifically, this phase of the SRI will include the following investigation elements:

1. Performance of a preliminary investigation to address LNAPL data gaps, including additional delineation of the vertical extent of LNAPL in areas where LNAPL is known to be present, and determination of representative LNAPL saturation values;
2. Installation of three new monitoring wells to further evaluate the extent of the shallow perched aquifer at the Site, and its relationship to Lake Chelan; and
3. Collection of shallow soil samples to evaluate current concentrations of selected gasoline constituents in soil in the vicinity of monitoring well MW-5.

As discussed in more detail in the following sections, portions of the work proposed for this phase of the SRI are considered preliminary and are not intended to result in the complete delineation of the extent of petroleum hydrocarbon contamination at the Site. Therefore, Leidos anticipates that at least one additional phase of investigation will be necessary to complete the SRI for the Site. The scope of work for future SRI activities will be determined based on the findings of the work described herein.

2. PRELIMINARY INVESTIGATION TO ADDRESS LNAPL DATA GAPS

As documented in the December 2006 Remedial Investigation and Feasibility Study Report for the Site (SAIC, 2006), previous investigation activities have included soil sampling at over 50 discrete soil boring locations and installation of 38 groundwater monitoring wells. These investigations have confirmed the presence of gasoline-range LNAPL in multiple monitoring wells to the west and southwest of the Chevron service station property, some of which are located more than 500 feet distant of the station. Subsequent long-term LNAPL gauging results, which were most recently reported in the Supplemental Remedial Investigation Report – Phase 1 (Leidos, 2015), indicate that in some of these monitoring wells LNAPL has routinely been measured at thicknesses of several feet or more, even while routine bailing efforts were being performed on an approximate monthly basis.

Despite the extensive subsurface investigation data that has been collected to date, numerous questions still remain regarding the presence of LNAPL at the Site, including:

- The lateral and vertical extent of LNAPL present;
- Transport mechanisms and pathways, and the number of petroleum sources, that have resulted in the current configuration of the LNAPL plume(s);
- The hydrogeologic condition(s) under which LNAPL is present (i.e., unconfined, confined, or perched);
- The approximate range and distribution of LNAPL saturation values at the Site; and
- The approximate mass of LNAPL present at the Site and the portion of the LNAPL that may be recoverable.

In order to begin to address these data gaps, Leidos will perform a preliminary investigation that will include the following components:

- Use of laser-induced fluorescence (LIF) technology to collect additional data regarding the vertical extent of LNAPL in select areas where LNAPL is known to be present; and
- Collection of soil core samples and soil confirmation samples to verify the results of the LIF investigation and to develop "worst case" estimates for LNAPL saturation values at the Site.

2.1 LIF INVESTIGATION

LIF is an investigation technique with the potential to rapidly identify the presence of petroleum fuels and other hazardous non-aqueous phase liquids (NAPLs) in the subsurface. This technology uses laser light to excite fluorescent molecules present in the NAPL, the response of which can be measured in real time to determine the vertical extent of NAPL at a boring location. The fluorescence intensity and colors emitted by the chemicals present can be used to identify the chemical and determine the relative saturation throughout the boring. Therefore, LIF waveform data can also be used to differentiate between NAPL types, which is useful at complex sites with more than one potential NAPL source. LIF tooling is typically advanced into the subsurface using direct push drilling technologies.

Due to the results of prior drilling activities at the Site, which typically have encountered gravel and cobbles at depths of approximately 5 to 15 feet below ground surface (bgs), LIF was previously thought to be poorly suited for conditions encountered. After further evaluation and in consideration of advances that have been made with direct push drilling equipment, Leidos believes that LIF may be a cost-effective strategy for LNAPL delineation within certain lithologic units at the Site. However, as the suitability of using LIF at the Site is still largely unknown, the scope for the current LIF investigation is somewhat limited and this first use of LIF is considered as a test for the technology at the Site. Therefore, the goals for this initial use of LIF at the Site are to:

- Collect additional data to determine vertical delineation in areas where LNAPL is known to be present;
- Collect additional data to evaluate the potential for multiple LNAPL sources through waveform data and vertical delineation; and
- Evaluate the suitability, performance, and cost-effectiveness for using LIF to complete additional LNAPL delineation at the Site.

2.1.1 LIF Investigation Locations

Based on the goals of the LIF investigation, Leidos has identified six proposed locations to complete LIF borings. The proposed boring locations are shown on Figure 1 and the justification for their selection is provided below.

As previously stated, one primary goal of the LIF investigation is to collect additional data regarding the vertical extent of LNAPL in areas where LNAPL is known to be present. Therefore, each of the locations proposed is in the vicinity of an existing or former monitoring well where LNAPL is known or expected to be present, based on existing data.

Actual boring locations will be based on conditions encountered in the field and will be subject to approval from the City of Chelan, or affected property owners.

MW-10/MW-12:

Monitoring well MW-10 is located immediately west of the Chevron service station property, in the driveway for the drive-up window for the Wells Fargo Bank. Monitoring well MW-12 is located a short distance further west, within the parking zone on the south side of East Woodin Avenue. Soil sampling results and boring logs from 2001, when the wells were installed, provide little data to define the vertical extent of contamination at these locations. For MW-10, the soil samples analyzed showed non-detect results for all analytes tested, and photo-ionization detector (PID) results were all generally low (≤ 20 parts per million [ppm]). Samples collected at 5-foot intervals between 20 and 31.5 feet bgs indicate that hydrocarbon odor was observed, but otherwise there is little evidence to indicate the presence of petroleum contamination. Results for MW-12 are similar, except that benzene was detected in the soil sample collected at 26.5 feet bgs and a PID reading of 1,645 ppm was recorded for the sample collected at 31.5 feet bgs. However, that sample was not submitted for laboratory analysis.

Despite the lack of evidence indicating the presence of petroleum contamination in soil at these locations, monitoring wells MW-10 and MW-12 have consistently contained measurable LNAPL since being installed in 2001. Both of these wells have frequently contained LNAPL at thicknesses greater than 1 foot, and gauging results for MW-10 routinely indicate that the well casing contains LNAPL only.

Based on the proximity of these monitoring wells to the Chevron service station property, and the initial data suggesting that petroleum contamination was first encountered at depths of approximately 20 to 25 feet bgs in these borings, Leidos believes that petroleum impacts at these locations are likely attributable to the Chevron service station property.

LIF investigation is proposed in this area due to the long-term recurrence of measurable LNAPL in these monitoring wells, as well as the lack of data to adequately define the vertical extent of LNAPL present. Due to the location of monitoring well MW-10, which is located in the drive-way for the Wells Fargo Bank, a LIF boring immediately adjacent to MW-10 is currently considered not feasible. Therefore, and in consideration of the relatively close proximity of these two monitoring wells, Leidos proposes that a single LIF boring location, approximately equidistant from both wells, be utilized for the LIF investigation.

MW-9:

Monitoring well MW-9 is located to the southwest of the Chevron service station property, in the parking lot south of the Wells Fargo Bank building. Similar to monitoring well MW-10, field

screening and soil sampling results for MW-9 do not provide sufficient evidence to delineate the vertical extent of LNAPL at this location. The boring log for this well indicates low PID results (≤ 18 ppm) for all samples collected, and hydrocarbon odor was noted in association with several of the samples. One sample, collected at a depth of 20 feet bgs, was submitted for laboratory analysis and was found to contain relatively low levels of GRO and benzene that were greater than MTCA Method A cleanup levels.

Like MW-10, monitoring well MW-9 has routinely contained LNAPL since its installation in 2001, often at thicknesses of several feet or more. LIF investigation is proposed in this area due to the long-term recurrence of measurable LNAPL in this monitoring well, and the lack of data to adequately define the vertical extent of LNAPL present.

MW-11:

Monitoring well MW-11 was located to the southwest of the Chevron service station, in the City of Chelan parking lot north of Wapato Avenue. This well was typically found to be dry and measurable LNAPL was never gauged at this location. However, soil sampling results from September 2001 indicate that gasoline-range organics (GRO) were detected at a concentration of 8,800 milligrams per kilogram (mg/kg) for the soil sample collected at 26.5 feet bgs, which suggests that LNAPL is present. This location is proposed in order to collect additional data regarding the vertical extent of LNAPL in the southern portion of the Site, where the shallow perched aquifer is not believed to be present.

MW-16:

Monitoring well MW-16 is located in a parking zone on the east side of South Emerson Street, south of East Woodin Avenue. Like the locations previously proposed, soil sampling data from the well's installation in 2001 provides little data to suggest that LNAPL was present at this location. PID measurements for all samples were relatively low (≤ 67 ppm) and there was only one detection of a petroleum constituent above MTCA Method A cleanup levels (benzene at 0.046 mg/kg in the sample collected at 40 feet bgs). Sample descriptions contain some mention of hydrocarbon odor beginning at approximately 25 feet bgs.

Long-term LNAPL gauging results indicate that MW-16 has typically contained LNAPL since 2002, frequently at thicknesses of several feet or more. LIF investigation is proposed in this area due to the long-term recurrence of measurable LNAPL in this monitoring well, and the lack of data to adequately define the vertical extent of LNAPL present.

MW-21:

Monitoring well MW-21 is located near the northwest corner of the intersection of East Woodin Avenue and South Emerson Street. Soil samples collected during installation of this well in March 2003 indicate that GRO was detected at a concentration of 11,000 mg/kg at a depth of 15 feet bgs. Benzene was also detected in the same sample at a concentration of 19 mg/kg. Due to the shallow depth of these detections, as well as the benzene concentration, which is high relative to soil sampling results for locations closer to the Chevron service station, it is believed that the petroleum contamination detected at MW-21 is likely attributable to a different, yet currently unidentified source. Recent LNAPL fingerprinting analysis performed by Chevron also supports this theory.

Despite the detection of GRO in soil at 11,000 mg/kg, which suggests the presence of LNAPL, long-term groundwater monitoring results from March 2003 through December 2015 indicate

that LNAPL was never detected in this well. However, the first occurrence of LNAPL was recently detected in this monitoring well during the March 2016 quarterly sampling event, at a thickness of 1.23 feet, and LNAPL was detected during the June 2016 and September 2016 sampling events, at thicknesses of 6.60 feet and 14.86 feet, respectively. Additional investigation utilizing LIF in the vicinity of monitoring well MW-21 is proposed in order to further evaluate the potential that petroleum impacts in this area are not associated with the Chevron service station.

MW-36:

Monitoring well MW-36 is located near the southwest corner of the intersection of East Woodin Avenue and South Emerson Street. Soil samples collected during the installation of this well in June 2003 indicate that GRO was detected (up to 30 mg/kg) in soil samples collected from depths ranging from 15 to 50 feet bgs. The boring log for this well indicates that during removal of the lower 20 feet of auger flights, red gasoline product was observed on the soil on the augers. During LNAPL gauging events conducted in June, July, and September 2003, in-well LNAPL was measured at thicknesses ranging from 9.00 to 11.55 feet; however, during subsequent gauging events LNAPL thickness in the well was typically less than 1 foot, and gauging results often indicate that no LNAPL is present. LIF investigation in this area is proposed in order to better understand the vertical distribution of LNAPL that has resulted in the somewhat anomalous data set for this monitoring well.

2.1.2 LIF Boring Preparation

Prior to the start of SRI Phase 2 field activities, the proposed location for each LIF boring will be approved by the City of Chelan, or relevant property owner. Boring locations will undergo a thorough utility locating process, which will include notification of the Utilities Underground Location Center, and performance of a private utility locating survey. If the location of any proposed boring must be changed based on the results of the utility locating surveys, Leidos will notify the property owner of the change prior to breaking ground at that location.

In order to comply with current Chevron requirements for subsurface asset avoidance, each boring will initially be cleared to a depth of at least 8 feet bgs using an air-vacuum excavation system or similar “soft-dig” method to avoid damage to buried utilities or other subsurface infrastructure. Within this interval, the diameter of the boring is required to be at least 3 inches larger than the largest diameter of tooling to be advanced into the boring. Therefore, the diameter will likely be at least 10 to 12 inches, and may be larger depending on the geology encountered. Air-vacuum excavation services will be provided by Cascade Drilling, L.P. (Cascade) of Woodinville, Washington. Based on previous investigation work performed at this Site, the air-vacuum excavation boring clearance work is expected to be very time consuming, with only two to three holes completed per day.

A Leidos representative will oversee the borehole clearance process and will collect soil samples from the boring at approximate 2-foot intervals using a stainless steel hand-auger. Samples will be classified and logged in accordance with the Unified Soil Classification System and will be field-screened for the presence of petroleum hydrocarbons by visual and olfactory observations, headspace vapor measurements using a PID, and sheen testing. Although petroleum contamination is not expected to be encountered in the borehole clearance interval, Leidos will be prepared to collect soil samples for analysis if field-screening results indicate that

contamination has been encountered. Selected samples will be analyzed according to the procedures presented in Section 2.2.4.

Borehole clearance work is expected to begin approximately one week prior to any subsequent drilling work. Therefore, following completion of the clearance process, each borehole will be backfilled with native material to approximately 6 inches bgs and finished with a temporary asphalt or concrete cap suitable for pedestrian and vehicle traffic.

Following completion of the borehole clearance process, each LIF boring will undergo additional preparation by using a sonic drill rig to advance the boring through the remaining portion of Lithologic Unit A (as described in the 2006 RI/FS report) and set a 4-inch diameter PVC casing from the ground surface to the top of Lithologic Unit B. Due to the gravel and cobble layers that have typically been encountered in Unit A, Leidos believes this step is necessary to ensure that the LIF tooling can be pushed into Lithologic Unit B, which is the silt and clay unit where most of the contamination at the Site is present. During this process, the sonic drill rig will collect a continuous core sample from the ground surface to the approximate interface of Lithologic Units A and B (estimated to be approximately 15 to 20 feet bgs) at each location. Sonic cores (except for the borehole clearance backfill interval from 0 to 8 feet bgs) will be classified, logged, and field-screened by a Leidos representative. Leidos will be prepared to collect soil samples for analysis from within this interval if field-screening results indicate that contamination has been encountered. Selected samples will be analyzed according to the procedures presented in Section 2.2.4.

2.1.3 LIF Data Collection and Analysis

Following preparation of the LIF boring locations, a direct-push rig will be used to advance the LIF tooling into Lithologic Unit B at each location. The LIF tooling will consist of an Ultra Violet Optical Screening Tool (UVOST®), manufactured by Dakota Technologies, Inc.

As the UVOST® probe is advanced into the subsurface, the tool will transmit pulses of laser light through a clear sapphire window located on the side of the probe. The light pulses will shine onto the face of soil passing the sapphire window, resulting in fluorescence and/or scattered laser light in response to the presence of polycyclic aromatic hydrocarbons (PAHs) found in petroleum LNAPL. The resulting fluorescence response is processed and analyzed in real time to create a continuous log of fluorescence intensity versus depth. The UVOST® will also measure and create a continuous log of electrical conductivity versus depth, which can be used to estimate grain size. Each LIF boring will be advanced to a depth sufficient to define the bottommost extent of LNAPL present or until reaching refusal with the direct-push rig, whichever comes first. Data collected at each LIF boring location will be in real time, which will allow for review and decision making in the field.

2.2 SOIL CORE COLLECTION AND CONFIRMATION SAMPLING

In association with the LIF investigation, Leidos will also collect soil core samples and confirmation soil samples at three select locations in order to further evaluate the vertical delineation data collected using LIF. The objective of this work will be to verify the real-time data provided by the LIF investigation, and to use the LIF data to collect soil core samples that will be used to assess LNAPL saturation from select locations at the Site. This component of the investigation will consist of the following tasks:

- **Soil Core Sample Collection** – Based on the results of the LIF investigation, Leidos will identify specific vertical intervals within the soil column representative of "worst-case" conditions for LNAPL saturation for three locations at the Site. Within these intervals, undisturbed soil core samples will be collected using thin-walled sampling tubes (i.e., Shelby tubes), which will be submitted to a laboratory for digital imaging and saturation analysis.
- **Soil Confirmation Sampling** – Based on the results of the LIF investigation, Leidos will identify specific vertical zones within the soil column for collection of soil confirmation samples. The objective of this activity will be to visually observe and field screen soils within specific depth intervals and to collect samples for laboratory analysis to verify the absence or presence of petroleum hydrocarbon contamination at target depths. This exercise will also allow semi-quantitative values to be assigned to the response signals presented in the LIF logs.

The soil core collection and confirmation sampling cannot be completed within boreholes used for the LIF investigation; therefore, additional borings will be completed adjacent to three of the LIF boreholes. It is expected that the soil core collection and confirmation sampling boreholes will be located approximately 3 to 5 feet from the corresponding LIF boreholes. However, actual borehole locations will be determined based on conditions encountered in the field.

In order to allow the SRI Phase 2 field work to be conducted in a timely and efficient manner, Leidos has pre-selected the sampling locations for the soil core and confirmation sample collection, based on available data for the Site. Pre-selection of these locations will allow all borehole clearance activities to be performed during a single crew and equipment mobilization, which will likely be completed prior to the start of any drilling activities.

Proposed borehole locations for the soil core collection and confirmation sampling scope of work are shown on Figure 1 and are described in the following section.

2.2.1 Soil Core Collection and Confirmation Sampling Locations

Soil core collection and confirmation sampling is proposed for the following locations:

MW-10/MW-12 - Based on long-term LNAPL gauging data, the area in the vicinity of monitoring wells MW-10 and MW-12 is expected to represent worst-case LNAPL saturation conditions in the eastern portion of the Site, near the Chevron service station property.

MW-16 - Based on long-term LNAPL gauging data, the area near monitoring well MW-16 is expected to represent worst-cast LNAPL saturation conditions in the central portion of the Site, along South Emerson Street.

MW-21 - Based on soil sampling results from 2003, as well as recent LNAPL gauging results that indicate the LNAPL has been measured at thicknesses of up to 14.86 feet, the area in the vicinity of monitoring well MW-21 is expected to be representative of worst-case LNAPL saturation conditions in the western portion of the Site, west of South Emerson Street.

2.2.2 Soil Core and Confirmation Sample Collection

Borehole location approval and utility clearance procedures for the soil core and confirmation sampling borings will be the same as presented in Section 2.1.2 for the LIF investigation borings.

Prior to initiating each boring, the Leidos project manager and field manager will determine the target zone for collection of the Shelby tube samples, and may identify other vertical zones of

interest, based on the results of the LIF investigation. Cascade Drilling will use a sonic drill rig to collect the Shelby tube samples and the confirmation soil samples.

At each location, the sonic rig will be used to advance a boring from the ground surface (through the previously cleared boring interval) to a depth approximately 1 foot above the top of the target interval for Shelby tube sampling. Within this upper interval, the sonic rig will collect a continuous core sample (typically in 5 to 10 foot increments), which will be extruded into polyethylene sample sleeves that will be labeled to identify their approximate top and bottom depth and orientation. The sonic cores will be photographed and logged in the field by a Leidos geologist and field-screened for the presence of petroleum hydrocarbons. Within this interval, samples may be collected for laboratory analysis based on results of the LIF investigation, or based on the results of the field-screening analyses.

Upon reaching a depth approximately 1 foot above the target interval for the Shelby tube core collection, the sonic rig will be used to advance one or more Shelby tubes samples, as necessary to collect core samples through the target interval. Shelby tubes will be 3-inch diameter thin-walled steel tubes, which will be 30 or 36 inches long.

Following advancement of the each Shelby tube core sample to the desired depth, the tubes will be quickly brought to the surface, removed from the drill string, and immediately placed in a horizontal position. If any void space is present at the ends of the tubes, the spaces will be filled tightly with plastic wrap (e.g., Saran™ Wrap) to help minimize core movement during transport. Each end of the tubes will then be fitted with a plastic end cap that will be taped in place using clear packaging tape. End caps will be labeled either “Top” or “Bottom” and each core section will be labeled with the top and bottom depths to the nearest 0.5 foot. If there are multiple cores from a single boring location, the cores will be labeled sequentially using A, B, C…etc., starting with A on the uppermost (i.e., shallowest sleeve). Cores will be immediately placed in coolers containing dry ice in order to minimize core pore fluid migration. Coolers will be shipped at the end of each day by overnight courier for next day delivery to the laboratory.

Upon completion of the Shelby tube sampling at each location, Cascade will resume standard sonic drilling operations to further advance the boring for collection of confirmation soil samples. Each boring will be advanced until field-screening results suggest that the bottom-most extent of petroleum impacts have been reached. Within the lower sonic interval of each boring, Leidos will collect at least one soil sample for laboratory analysis to confirm that the lower extent of petroleum contamination has been reached. Additional samples may also be collected for laboratory analysis based on results of the LIF investigation, or based on the results of the field-screening analyses.

2.2.3 Soil Core Sample Analysis

Soil core samples will submitted to Core Lab, Petroleum Services Division (Core Lab) in Bakersfield, California. All of the core samples will initially be prepared by being cut lengthwise and then analyzed by digital core imaging procedures, under white and ultraviolet (UV) light conditions. The digital imaging procedure will provide a photographic record of each core and the photograph under UV light conditions will cause LNAPL to fluoresce, if present, which will indicate the saturation profile and apparent concentration. Following completion of this procedure, the cores will be returned to frozen storage and held for future petrophysical analyses, and the process images will be submitted to Leidos for review.

Based on the images provided, Leidos will identify approximately one sample from each borehole location, which will be submitted for mobility testing by centrifuge method. It is expected that each sample selected will be representative of the interval of greatest LNAPL saturation, as identified by the UV imaging for that core. The mobility testing procedure will provide the following data for each sample:

- Initial LNAPL saturation;
- Residual LNAPL saturation;
- Total porosity; and
- Grain and dry bulk density.

2.2.4 Soil Sample Analysis

Selected soil samples collected in association with the preliminary LNAPL data gaps investigation activities will be submitted to Eurofins Lancaster Laboratories for the following analyses:

- Gasoline-range organics (GRO) by ECY 97-602 NWTPH-Gx;
- Diesel-range organics (DRO) and heavy oil-range organics (HRO) by ECY 97-602 NWTPH-Dx;
- DRO and HRO by ECY 97-602 NWTPH-Dx with silica-gel cleanup;
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX), methyl tertiary butyl either (MTBE), ethylene dibromide (EDB), and 1,2 dichloroethane (EDC) by USEPA 8260B; and
- Total lead by USEPA 6010B.

Duplicate soil samples will be collected at a rate of one per each 20 soil samples and submitted for the above-referenced analyses to ensure quality assurance and quality control (QA/QC).

Additional QA/QC samples will include one trip blank to accompany each sample cooler, and equipment rinse samples to verify equipment decontamination procedures. Equipment rinse sampling will be performed by collecting laboratory-supplied distilled water that has been used as the final rinse following equipment decontamination procedures. Equipment rinse samples will be collected at a rate of one per sample collection method (e.g., hand-auger or sonic core barrel). Trip blank and equipment rinse QA/QC samples will be submitted for the following analyses:

- GRO by ECY 97-602 NWTPH-Gx; and
- BTEX, MTBE, EDB, and EDC by USEPA 8260B.

Laboratory analytical quantitation limits for soil sample analyses are presented in Appendix A.

3. MONITORING WELL INSTALLATION

As discussed in the 2006 RI/FS report, based on results from the previous remedial investigation activities, SAIC concluded that the petroleum-impacted shallow perched aquifer extends to the south only as far as the alley between Woodin and Wapato Avenues, except near MW-9 which is just south of the alley. Southward from this alley, the perched water table was described as

becoming steeper and terminating against the upper till layer of Lithologic Unit C. These conclusions were supported by groundwater elevation data from ten former monitoring wells located in the southwest portion of the Site, which indicated that groundwater was not present at elevations below the surface elevation of Lake Chelan. Based on these data, SAIC further concluded water from the perched aquifer on the downgradient southwest side of the Site cannot physically reach Lake Chelan.

Despite the available data indicating that shallow groundwater has typically not been encountered in monitoring wells south of the alley, recent analysis of groundwater elevation data collected at the Site since 1992 indicates that long-term trends in shallow groundwater elevation have occurred that were previously not identified, and therefore were not considered prior to the abandonment of monitoring wells in the southern portion of Site. In addition, this recent analysis also suggests that groundwater elevation in the western portion of the shallow perched aquifer (i.e., in monitoring wells MW-23 and MW-19) appears to be affected by seasonal changes in the surface level of Lake Chelan, which is actively managed by the Chelan County Public Utilities District.

Based on these recent findings, Leidos believes that further investigation is needed in the southwest portion of the Site in order to evaluate long-term groundwater elevation trends and their impact on the extent of the shallow perched aquifer in this area, as well as the potential for communication between the aquifer and Lake Chelan. To address these data gaps, Leidos proposes to install three new monitoring wells in the southwestern portion of the Site. Proposed well locations are shown on Figure 1. Additional details regarding each location are provided in the following section.

3.1 MONITORING WELL LOCATIONS

- Monitoring well MW-38 will be installed in the vicinity of the northeast corner of the intersection of East Wapato Avenue and South Emerson Street. Unlike existing monitoring well MW-31, which is also located in this vicinity but which is screened within the deep water-table aquifer, MW-38 will be constructed to intercept groundwater from the shallow perched aquifer, if present.
- Monitoring well MW-39 will be installed near the southwest corner of the parking lot north and east of Chelan Riverwalk Park. This monitoring well will be located in the vicinity of former monitoring well MW-20.
- Monitoring well MW-40 will be installed in the western portion of the parking lot north and east of Chelan Riverwalk Park. This monitoring well will be located approximately 90 feet west of former monitoring wells MW-26 and MW-35.

3.2 MONITORING WELL SOIL BORING AND SAMPLING

Borehole location approval and utility clearance procedures for the monitoring well installation borings will be the same as presented in Section 2.1.2 for the LIF investigation borings.

Following completion of the borehole clearance procedure, Cascade Drilling will use a sonic drilling rig to advance each boring to the depth necessary to meet the monitoring well objectives at each location. Within this interval, the sonic rig will collect a continuous core sample (typically in 5 to 10 foot increments), which will be extruded into polyethylene sample sleeves that will be labeled to identify their approximate top and bottom depth and orientation. The

sonic cores will be photographed and logged in the field by a Leidos geologist and field-screened for the presence of petroleum hydrocarbons.

At a minimum, two soil samples will be collected and submitted for laboratory analysis: one from the capillary fringe, and the second from the bottom-most sample interval attained in the boring. The bottom-most sample will be used to demonstrate that the sampling effort has advanced to sufficient depth to define the vertical extent of petroleum-hydrocarbon impacts, if present. Additional soil samples may also be submitted based on field-screening observations. For example, the sample producing the highest PID readings, strongest sheen, or otherwise having the greatest visual or olfactory indication of petroleum-hydrocarbon impact may also be submitted for laboratory analysis. Samples selected for laboratory analysis will be analyzed according to the procedures presented in Section 2.2.4.

3.3 MONITORING WELL CONSTRUCTION AND DEVELOPMENT

Following the completion of drilling and sampling activities at each location, each boring will be completed as a 2-inch diameter monitoring well. As previously discussed, the objective for installing these wells is to evaluate the extent of the shallow perched groundwater to the southwest of the Site and the potential for communication with Lake Chelan. Therefore, the depth and screened interval of these wells must be sufficient to provide groundwater elevation monitoring data within normal operating range of the lake surface elevation, and account for long-term changes in groundwater elevation, which have routinely varied by values of 10 feet or more.

According to information obtained from the Chelan County PUD website, the lake level is typically maintained within a range of 1,084 to 1,100 feet above sea level during most years; however, the lake level may be lowered below that range during extremely wet years. The current license minimum level for the lake is 1,079 feet.

Based on this information, each monitoring well will be constructed with a 25-foot screened interval that extends from an elevation of approximately 1,075 to 1,100 feet above sea level. As constructed, these wells will be sufficiently deep to determine whether groundwater is present in this area at an elevation that is sufficient to induce groundwater to flow toward the lake.

As previously discussed, based on previous groundwater monitoring data for monitoring wells located southwest of the Site, Leidos believes that it is likely that one or more of the proposed monitoring wells will not intersect a water-bearing zone. If sufficient groundwater is present within the screened interval of the wells, the wells will be developed for future sampling. Well development will consist of surging for 10 minutes and pumping at least 10 well-casing volumes of groundwater from the well using an electric submersible pump until water produced from the well is clear and free of sediment.

3.4 MONITORING WELL LOCATION AND ELEVATION SURVEY

Following installation of the new wells, Leidos will subcontract a Washington State licensed land-surveying firm to perform a location and elevation survey of the new monitoring wells. Monitoring well elevation measurements will be made to the nearest 0.01 foot at the ground surface (i.e., top of well-box lid) and at the top of the well casing, relative to the North American Vertical Datum of 1988. Monitoring well location measurements will be made relative to the North American Datum 1983 High Accuracy Reference Network [NAD83(HARN)] .

3.5 GROUNDWATER MONITORING

Following completion of the monitoring well installation activities, each of the three new monitoring wells will be added to the current quarterly groundwater monitoring program for the Site, which is managed and performed on behalf of Chevron by Gettler-Ryan, Inc. (Gettler-Ryan).

Groundwater monitoring will consist of LNAPL thickness and water level measurements, and groundwater samples will be collected for laboratory analysis if sufficient groundwater is present and no LNAPL is present. When conditions permit, groundwater samples will be collected using low-flow purging and sampling techniques and will be submitted to Eurofins Lancaster Laboratories for the following analyses:

- GRO by ECY 97-602 NWTPH-Gx; and
- DRO and HRO by ECY 97-602 NWTPH-Dx;
- DRO and HRO by ECY 97-602 NWTPH-Dx with silica-gel cleanup;
- BTEX, MTBE, and EDC by USEPA 8260B;
- EDB by USEPA 8011; and
- Total lead and dissolved lead by USEPA 6010B.

Laboratory analytical quantitation limits for groundwater sample analyses are presented in Appendix A.

4. SUPPLEMENTAL SHALLOW SOIL SAMPLING AND ANALYSIS

4.1 BACKGROUND

As more completely discussed in Section 4.3 of the 2006 RI/FS report, all soil sampling results from the Site exceeding MTCA Method A cleanup levels have been collected from depths of 15 feet (bgs) or more, with the exception of one sample collected from 12.5 to 14 feet bgs in the boring for monitoring well MW-5, which contained benzene at a concentration of 0.517 milligrams per kilogram. Due to the date that this sample was collected (1992), the 2006 RI/FS report suggested that this relatively low-level, shallow soil contamination may have been addressed by the soil vapor extraction system that was previously operated at the Site and/or biodegradation that has taken place since that time.

In order to address this data gap, two soil borings will be advanced in the vicinity of monitoring well MW-5 in order to perform additional characterization of shallow soils in this area. One soil boring is proposed to be located approximately 10 feet to the east of monitoring well MW-5, and the second boring is proposed to be located approximately 10 feet to the west (Figure 1). Actual boring locations will be based on conditions encountered in the field, and may be modified due to their proximity to an overhead utility line known to exist in this area, or other utilities that may be located in the area.

4.2 SOIL BORING AND SAMPLING PROCEDURES

Borehole location approval and utility clearance procedures for the shallow soil sampling borings will be the same as presented in Section 2.1.2 for the LIF investigation borings.

Following completion of the borehole clearance procedure, Cascade Drilling will use a sonic drilling rig to advance each boring to a depth of 15 feet bgs. Within this interval, the sonic rig will collect a continuous core sample (typically in 5 to 10 foot increments), which will be extruded into polyethylene sample sleeves that will be labeled to identify their approximate top and bottom depth and orientation. The sonic cores will be photographed and logged in the field by a Leidos geologist and field-screened for the presence of petroleum hydrocarbons. Confirmation samples will be collected for laboratory analysis from the bottom of each boring. Additional samples may also be collected for laboratory analysis if field-screening results indicate that contamination has been encountered

QA/QC sampling will include collection of one trip blank, one duplicate sample, and equipment rinse samples from the hand-auger and down-hole tooling of the drill rig.

Selected soil samples, and the QA/QC samples, will be submitted to Lancaster Laboratories for the following analyses:

- GRO by ECY 97-602 NWTPH-Gx; and
- BTEX, MTBE, EDB, and EDC by USEPA 8260B.

Laboratory analytical quantitation limits for soil sample analyses are presented in Appendix A.

5. SOIL BORING ABANDONMENT

Soil borings that will require abandonment in association with the SRI Phase 2 field activities will include:

- Six (6) LIF investigation borings;
- Three (3) soil core collection and soil confirmation sample borings; and
- Two (2) shallow soil sample borings in the vicinity of monitoring well MW-5.

Soil boring abandonment will be performed by Cascade Drilling in accordance with Chapter 173-160 of the Washington Administrative Code (WAC), "Minimum Standards for Construction and Maintenance of Wells." Each boring will be abandoned in place by being filled with grout or bentonite chips, and the ground surface at each location will be completed to match the surrounding surface. Boring located within City of Chelan right-of-ways will be completed at the surface based on all applicable permit conditions or requirements of the City of Chelan.

6. INVESTIGATION-DERIVED WASTE MANAGEMENT

Regulated investigation-derived waste (IDW) is anticipated to include soil cuttings and water that will be generated during drilling, equipment decontamination, and well development activities. All regulated IDW will be containerized in 55-gallon United States Department of Transportation-approved drums. Drums containing regulated IDW will be staged on the Chevron service station property, at a location that is acceptable to the property owner and station manager, until a waste disposal profile can be generated and off-site transportation and disposal can be arranged (typically 6 to 8 weeks). Waste disposal coordination for regulated IDW will be handled by the firm GHD, for Chevron.

Non-regulated IDW, such as nitrile gloves, plastic sheeting, and nylon tubing used for well purging, will be handled as standard municipal waste.

7. SCHEDULE

Leidos will begin project planning and permitting for this project upon receipt of Ecology approval of this work plan. Project planning and permitting is expected to require approximately four to six weeks to complete, prior to the initiation of investigation field activities. However, the schedule to begin field work at the Site may also be contingent on Chevron approval, property access, street-use or other permits, contractor availability, staffing resources, and weather concerns.

Leidos will provide Ecology with at least one week's notice prior to the start of any SRI field activities.

8. REFERENCES

Leidos (2015). "Supplemental Remedial Investigation Report – Phase 1, Chevron Service Station No. 9-6590." December 14.

SAIC (2006). "Final Remedial Investigation / Feasibility Study Report, Chevron Service Station No. 9-6590." December 2006.

LIMITATIONS

This technical document was prepared on behalf of Chevron and is intended for its sole use and for use by the local, state, or federal regulatory agency that the technical document was sent to by Leidos. Any other person or entity obtaining, using, or relying on this technical document hereby acknowledges that they do so at their own risk, and Leidos shall have no responsibility or liability for the consequences thereof.

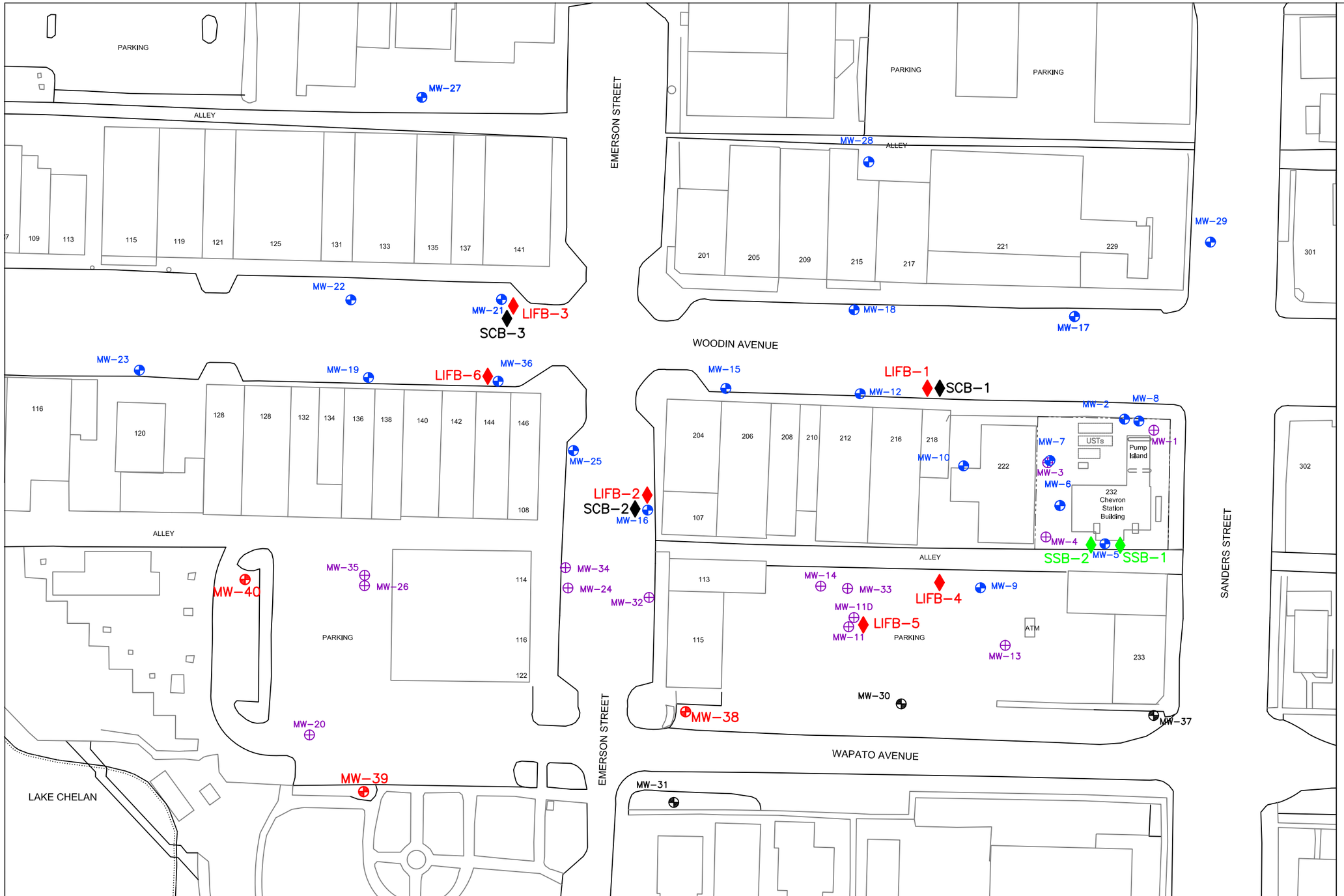
Site history and background information provided in this technical document are based on sources that may include interviews with environmental regulatory agencies and property management personnel and a review of acquired environmental regulatory agency documents and property information obtained from Chevron and others. Leidos has not made, nor has it been asked to make, any independent investigation concerning the accuracy, reliability, or completeness of such information beyond that described in this technical document.

Recognizing reasonable limits of time and cost, this technical document cannot wholly eliminate uncertainty regarding the vertical and lateral extent of impacted environmental media.

Opinions and recommendations presented in this technical document apply only to site conditions and features as they existed at the time of Leidos site visits or site work and cannot be applied to conditions and features of which Leidos is unaware and has not had the opportunity to evaluate.

All sources of information on which Leidos has relied in making its conclusions (including direct field observations) are identified by reference in this technical document or in appendices attached to this technical document. Any information not listed by reference or in appendices has not been evaluated or relied on by Leidos in the context of this technical document. The conclusions, therefore, represent our professional opinion based on the identified sources of information.

Figures



LEGEND

MW-2	PERCHED GROUNDWATER MONITORING WELL
MW-30	DEEP GROUNDWATER MONITORING WELL
MW-1	ABANDONED DRY MONITORING WELL
MW-2	PROPOSED GROUNDWATER MONITORING WELL LOCATION
LIFB-1	PROPOSED LIF BORING LOCATION
SCB-1	PROPOSED SOIL CORE AND SOIL CONFIRMATION SAMPLING LOCATION
SSB-1	PROPOSED SHALLOW SOIL SAMPLING LOCATION
204	STREET ADDRESS

N

NOTES

Base Map from City of Chelan, 1994

Additional Reference Material:
Aerial Photograph from September 1991
(Washington State Department of Natural Resources)

0 80' 160'

leidos

Chevron Service Station No. 96590
232 East Woodin Avenue
Chelan, Washington

FIGURE 1
Site Map with Proposed SRI Phase 2 Investigation Locations

FILE NAME: 96590_Site Map.dwg

DATE: 10/05/2016

Appendix A:
Laboratory Analytical Quantitation Limits

Appendix Table A-1
Soil Sample Analysis
Target Analytes, Laboratory Methods, and Analytical Limits

Analyte	Soil					
	Analytical Method	MDL	LOD	LOQ	LCS	RPD
		(mg/kg)			(%)	
Petroleum Hydrocarbons						
Gasoline Range Hydrocarbons	NWTPH-Gx	1	2	5	80-120	≤ 30
Diesel-Range Hydrocarbons	NWTPH-Dx with Si-gel	3	--	7	50-133	≤ 20
Heavy Oil-Range Hydrocarbons	NWTPH-Dx with Si-gel	10	--	30	--	--
Diesel-Range Hydrocarbons	NWTPH-Dx	3	6	7	61-115	≤ 20
Heavy Oil-Range Hydrocarbons	NWTPH-Dx	10	20	30	--	--
Volatile Organic Compounds						
Benzene	USEPA 8260B	0.0005	0.002	0.005	80-120	≤ 30
Ethylbenzene	USEPA 8260B	0.001	0.002	0.005	80-120	≤ 30
Toluene	USEPA 8260B	0.001	0.002	0.005	80-120	≤ 30
Total Xylenes	USEPA 8260B	0.001	0.002	0.005	80-120	≤ 30
1,2 Dichloroethane (EDC)	USEPA 8260B	0.001	0.002	0.005	70-133	≤ 30
Ethylene dibromide (EDB)	USEPA 8260B	0.001	0.002	0.005	80-120	≤ 30
Metals						
Total Lead	USEPA 6010	0.55	1.5	1.5	80-120	≤ 20

LCS = laboratory control sample (supplied by Eurofins Lancaster Labs)
LOD = limit of detection (supplied by Eurofins Lancaster Labs)
LOQ = limit of quantitation (supplied by Eurofins Lancaster Labs; equivalent to PQLs or RLs)
MDL = method detection limit (supplied by Eurofins Lancaster Labs)
RPD = relative percent difference (supplied by Eurofins Lancaster Labs)
mg/kg = milligrams per kilogram
-- Not applicable or not available

Appendix Table A-2
Groundwater Sample Analysis
Target Analytes, Laboratory Methods, and Analytical Limits

Analyte	Groundwater					
	Analytical Method	MDL	LOD	LOQ	LCS	RPD
		(ug/L)			(%)	
Petroleum Hydrocarbons						
Gasoline-Range Hydrocarbons	NWTPH-Gx	50	100	250	75-135	≤ 30
Diesel-Range Hydrocarbons	NWTPH-Dx with Si-gel	45	90	100	23-115	≤ 20
Heavy Oil-Range Hydrocarbons	NWTPH-Dx with Si-gel	100	250	250	--	--
Diesel-Range Hydrocarbons	NWTPH-Dx	45	90	100	32-115	≤ 20
Heavy Oil-Range Hydrocarbons	NWTPH-Dx	100	250	250	--	--
Volatile Organic Compounds						
Benzene	USEPA 8260B	0.5	1	1	78-120	≤ 30
Ethylbenzene	USEPA 8260B	0.5	1	1	78-120	≤ 30
Toluene	USEPA 8260B	0.5	1	1	80-120	≤ 30
Total Xylenes	USEPA 8260B	0.5	1	1	80-120	≤ 30
Methyl tert-butyl ether	USEPA 8260B	0.5	1	1	75-120	≤ 30
1,2 Dichloroethane (EDC)	USEPA 8260B	0.5	1	1	66-128	≤ 30
Ethylene dibromide (EDB)	USEPA 8011	0.01	0.02	0.03	60-140	≤ 20
Metals						
Lead (total or dissolved)	USEPA 6010	6.2	15	15	80-120	≤ 20

LCS = laboratory control sample (supplied by Eurofins Lancaster Labs)
LOD = limit of detection (supplied by Eurofins Lancaster Labs)
LOQ = limit of quantitation (supplied by Eurofins Lancaster Labs; equivalent to PQLs or RLs)
MDL = method detection limit (supplied by Eurofins Lancaster Labs)
RPD = relative percent difference (supplied by Eurofins Lancaster Labs)
µg/L = Micrograms per liter
-- Not applicable or not available